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Compact Facility for Boron Neutron Capture Therapy and for Explosive Detection

Yu. Belchenko, A. Burdakov, V. Davydenko, A. Ivanov, V. Kobets, A. Kudryavtsev, V.Shirokov, S. Taskaev.

Budker Institute of Nuclear Physics, 11 Lavrentiev ave., 630090 Novosibirsk, Russia, taskaev@inp.nsk.su

Pilot innovative facility for boron neutron capture therapy (BNCT) and for explosive detection is under going to start operating now at Budker Institute of Nuclear Physics, Novosibirsk. This facility is based on compact vacuum insulation tandem accelerator with cw proton current up to 10 mA. Epithermal neutrons for BNCT is proposed to be generated by 1,915 MeV protons bombarding a lithium target using $^7Li(p,n)^7Be$ threshold reaction. Monochromatic 9.17 MeV γ-quantum for explosive detection by nuclear resonance absorption technique is proposed to be produced by 1,75 MeV protons bombarding a _arbon-13 target. In the report, the pilot facility design is given and design features of facility components are discussed. Current status of project realization and results of first experiments on monochromatic γ-rays generation are presented. The immediate plans are declared.

Accelerator epithermal neutron sources based on p-xn reaction

Marko Fülöp

Slovak Medical University

One from the most important applications of high intensity epithermal neutron beams is treatment of malignant tumors by boron neutron capture therapy (BNCT). At present time, the only sources of neutrons for BNCT are modified nuclear reactors. Nuclear reactors are not accepted for use at in-hospital environment, therefore development of accelerator based epithermal neutron sources (ABENS) with reasonable purchase price and operating costs is needed. ABENS consist of two basic parts: accelerator with target as a source of primary neutrons and assembly of moderators, reflectors and filters for shaping of primary neutron energy spectrum to the energy spectrum of epithermal neutrons that is suitable for BNCT.

Appropriate accelerators for ABENS based on p-xn reaction are high intensity radiopharmaceutical cyclotrons. Radiopharmaceutical cyclotrons are constructed for hospital environment and if they are also used for radiopharmaceutical production, operating expenses for BNCT is reasonable low. From this point of view, for example the proton cyclotron 30MeV for ^{123}I production is useful also for BNCT. The proton cyclotron 30MeV is commercially produced with beam intensity 700_A, which is enough for production of epithermal neutron beam intensity $10^9\ s^{-1}cm^{-2}$.

In the presentation designs of the ABENS were calculated for proton energies 18MeV (target Ag), 30MeV (target Pb and Ta) and 72MeV (target Pb) in accordance to free-in-air parameters published as IAEA targets. From presented results of calculations, it is possible to make an assumption of ABENS design for any chosen proton energy in region from 18MeV up to72MeV.